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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/091,106	03/05/2002	John Commander	CEDE 2036	5919

321 7590 08/24/2004

SENNIGER POWERS LEAVITT AND ROEDEL
ONE METROPOLITAN SQUARE
16TH FLOOR
ST LOUIS, MO 63102

EXAMINER

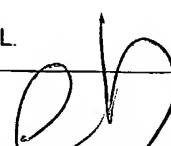
WONG, EDNA

ART UNIT	PAPER NUMBER
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1753

DATE MAILED: 08/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/091,106	COMMANDER ET AL.	
	Examiner	Art Unit	
	Edna Wong	1753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 July 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7, 14, 17, 28, 31, 43 and 54-59 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 1-7 and 43 is/are allowed.
- 6) ☒ Claim(s) 14, 28 and 54-59 is/are rejected.
- 7) ☒ Claim(s) 17 and 31 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

This is in response to the Amendment dated July 26, 2004. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Response to Arguments

Specification

The disclosure is objected to because of minor informalities.

The objection to the disclosure has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 112

I. Claims **2, 44 and 46** have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The rejection of claims 2, 44 and 46 under 35 U.S.C. 112, second paragraph, has been withdrawn in view of Applicants' amendment.

II. Claims **28, 33, 35, 43-47 and 52** have been rejected under 35 U.S.C. 112, second paragraph, as being incomplete for omitting essential elements, such omission amounting to a gap between the elements.

The rejection of claims 28, 33, 35, 43-47 and 52 under 35 U.S.C. 112, second

paragraph, has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 102

I. Claims **28 and 35** have been rejected under 35 U.S.C. 102(b) as being anticipated by **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claims 28 and 35 under 35 U.S.C. 102(b) as being anticipated by Dubin et al. has been withdrawn in view of the Examiner's new grounds of rejection.

II. Claims **43-47** have been rejected under 35 U.S.C. 102(b) as being anticipated by **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claims 43-47 under 35 U.S.C. 102(b) as being anticipated by Dubin et al. has been withdrawn in view of Applicants' amendment.

Claim Rejections - 35 USC § 103

I. Claims **1-7** have been rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claims 1-7 under 35 U.S.C. 103(a) as being unpatentable over Dubin et al. has been withdrawn in view of Applicants' amendment.

II. Claim **14** has been rejected under 35 U.S.C. 103(a) as being unpatentable over **Dubin et al.** (US Patent No. 5,972,192).

The rejection of claim 14 under 35 U.S.C. 103(a) as being unpatentable over Dubin et al. has been withdrawn in view of the Examiner's new grounds of rejection.

Response to Amendment

Claim Rejections - 35 USC § 112

Claim **54** is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 54

line 3, it appears that the "electroplating" is the same as that recited in claim 14, line 11. However, it is unclear if it is. If it is, then it is suggested that the word -- the -- be inserted after the word "during".

Claim Rejections - 35 USC § 103

I. Claims **14 and 54-59** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Kardos et al.** (US Patent No. 3,956,078) in combination with **Dubin et al.** (US Patent No. 5,972,192).

Kardos teaches a method for electroplating a copper deposit onto a substrate (= printed circuit board) [col. 1, line 60] comprising the steps of:

(a) immersing the substrate into an electroplating bath including ionic copper (= $\text{CuSO}_4 \cdot \text{H}_2\text{O}$) [col. 11, line 56 to col. 12, line 10] and an effective amount of a defect

reducing agent (= polyvinylpyridine) [col. 18, lines 53-60]; and

(b) electroplating the copper deposit from said bath onto the substrate (col. 12, lines 11-16).

The defect reducing agent improves distribution of deposited copper over the substrate surface (= leveling agent) [col. 9, lines 22-28].

Kardos does not teach wherein the substrate is a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs; and wherein the submicron sized reliefs are filled with the copper deposit.

However, Dubin teaches that copper plating compositions useful to plate circuit board substrates with small diameter, high aspect ratio microvias and other apertures will also be useful for plating integrated circuit devices, such as formed semiconductor devices and the like (col. 7, lines 56 to col. 8, line 67).

Thus, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Kardos with wherein the substrate is a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs; and wherein the submicron sized reliefs are filled

with the copper deposit because copper plating compositions useful to plate circuit board substrates with small diameter, high aspect ratio microvias and other apertures would have also been useful for plating integrated circuit devices, such as formed semiconductor devices and the like as taught by Dubin (col. 7, lines 56 to col. 8, line 67).

As to wherein the defect reducing agent reduces a rate of recrystallization and grain growth in the copper deposit, thereby reducing the formation of internal voids within the copper deposit, Kardos teaches that the leveling agent (= polyvinylpyridine) [col. 18, lines 53-60] also increases brightness, widens the current density, prevent roughness formation at high current density and increase hardness (col. 9, lines 22-28). It appears that the leveling agent can do many things. It has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to wherein the deposit subsequently undergoes recrystallization and grain growth at a reduced rate and thereby is characterized by a reduced concentration of internal voids, similar processes can reasonably be expected to yield products which inherently have the same properties. *In re Spada* 15 USPQ 2d 1655 (CAFC 1990); *In re DeBlauwe* 222 USPQ 191; *In re Wiegand* 86 USPQ 155 (CCPA 195).

As to wherein the defect reducing agent reduces high current density edge effect during electroplating, Kardos teaches that the leveling agent (= polyvinylpyridine) [col. 18, lines 53-60] also increases brightness, widens the current density, prevent roughness formation at high current density and increase hardness (col. 9, lines 22-28). It appears that the leveling agent can do many things. It has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to wherein the deposit has a deposit thickness of about 1 micron and which varies by no more than about 0.2 microns across the deposit, the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point, this is well within the skill of the artisan dependent upon the intended use of the device, particularly to the environment to which the device will encounter, which would be most suited for the application of the device, absent evidence to the contrary.

Furthermore, this is well within the skill of the artisan dependent upon the size of the features.

As to the deposit thickness being measured from an upper surface of the deposit to the substrate surface at its thickest point, if the deposit thickness varies by no more than about 0.2 microns across the deposit, then measuring the deposit thickness at its thickest point would have revealed this, and that any other point beyond this would have

been outside this range.

As to wherein the defect reducing agent facilitates deposition of a thinner overall deposit to achieve a minimum thickness across the substrate than an overall deposit required achieve such minimum thickness by electroplating without said defect reducing agent, Kardos teaches that the leveling agent (= polyvinylpyridine) [col. 18, lines 53-60] also increases brightness, widens the current density, prevent roughness formation at high current density and increase hardness (col. 9, lines 22-28). It appears that the leveling agent can do many things. It has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

As to removing a portion of the copper deposit by chemical and mechanical action to yield a level substrate, wherein an amount of copper deposit to be removed is less than an amount of copper deposit which must be removed by chemical and mechanical action to yield a level substrate in a comparable substrate electroplated without said defect reducing agent, Kardos appears to disclose a copper deposit at least in a similar manner as instantly claimed. Therefore, it would have been within the skill of the art to expect that removing a portion of the copper deposit by chemical and mechanical action to yield a level substrate, wherein an amount of copper deposit to be removed is less than an amount of copper deposit which must be removed by chemical

and mechanical action to yield a level substrate in a comparable substrate electroplated without said defect reducing agent.

As to wherein pitting corrosion from said chemical action is less severe than pitting corrosion in the comparable substrate electroplated without said defect reducing agent, Kardos teaches a similar process a presently claimed. Similar processes can reasonably be expected to yield similar results.

II. Claim **28** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Kardos et al.** (US Patent No. 3,956,078).

Kardos teaches a concentrate comprising:

- (a) copper ions ($= \text{CuSO}_4 \cdot \text{H}_2\text{O}$) [col. 11, line 56 to col. 12, line 10]; and
- (b) a defect reducing agent ($=$ polyvinylpyridine) [col. 18, lines 53-60].

Kardos does not teach for preparing a copper electroplating bath for electroplating a copper deposit onto a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein.

However, the invention as a whole would have been obvious to one having ordinary skill in the art at the time the invention was made because for preparing a

copper electroplating bath for electroplating a copper deposit onto a semiconductor integrated circuit device substrate having electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein does not compositionally distinguish the concentrate from the prior art.

As to which reduces defects from superfilling, surface roughness, and voiding due to uneven growth, and improves macro-scale planarity across the wafer, wherein the defect reducing agent reduces a rate of recrystallization and grain growth in copper deposited using said copper electroplating bath, thereby reducing the formation of internal voids in the deposited copper, Kardos teaches that the leveling agent (= polyvinylpyridine) [col. 18, lines 53-60] also increases brightness, widens the current density, prevent roughness formation at high current density and increase hardness (col. 9, lines 22-28). It appears that the leveling agent can do many things. It has been held that a newly discovered use or function of components does not necessarily mean the system is unobvious since this use or function may be inherent in the prior art. *Ex parte Pfeiffer* 135 USPQ 31.

Allowable Subject Matter

The following is a statement of reasons for the indication of allowable subject matter:

Claims **1-7** define over the prior art of record because the prior art does not teach

or suggest a method for electroplating a copper deposit onto a semiconductor integrated circuit device substrate with electrical interconnect features including submicron-sized features such that the surface has submicron-sized reliefs therein, the method comprising the steps of immersing and electroplating as presently claimed, esp., wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine.

Claim **17** defines over the prior art of record because the prior art does not teach or suggest the method of claim 14 wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine.

Claim **31** defines over the prior art of record because the prior art does not teach or suggest the concentrate of claim 28 wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine.

Claim **43** defines over the prior art of record because the prior art does not teach or suggest a concentrate comprising copper ions and a defect reducing agent, wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine.

The prior art does not contain any language that teaches or suggests the above. *Kardos et al.* do not teach wherein the defect reducing agent is a reaction product of benzyl chloride and hydroxyethyl polyethylenimine. Therefore, a person skilled in the art would not have been motivated to adopt the above conditions, and a prima facie case of obviousness cannot be established.

Claims 17 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

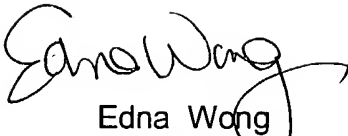
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Edna Wong whose telephone number is (571) 272-1349. The examiner can normally be reached on Mon-Fri 7:30 am to 3:30 pm, Flex Schedule.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Application/Control Number: 10/091,106
Art Unit: 1753

Page 13


Edna Wong
Primary Examiner
Art Unit 1753

EW
August 20, 2004